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What goes left and what goes right

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1 Introduction

In this paper, we take the Dynamic Syntax (DS) Framework (Kempson et al. 2001), and explore the extent to which it enables us to analyse constructions on the left and right peripheries of the sentence. What we show is that manipulating the dynamics of tree growth reflecting the left-right sequence of words as the form of syntactic explanation enables us to characterise both left and right-periphery phenomena in similar terms, while nevertheless bringing out the difference between them. We argue that the concept of nodes initially unfixed within a tree structure, the concept of inducing linked tree structures with the dynamics of passing information from one structure to another, and the analysis of anaphora as involving term substitution as an integral part of the tree growth process, enable us not only to account for individually puzzling phenomena such as pronoun doubling, ‘it extraposition’ and right-node raising, but to do so in ways which naturally bring out the asymmetry between these right-peripheral effects and the range of topic structures available at the left periphery.

Ever since the earliest days of generative syntax, right peripheral phenomena have tended to be considered secondary to well-studied constructions on the left periphery. While there are recent studies that tackle constructions like Heavy NP Shift and Right Node Raising directly (see particularly Hawkins 1994, Kayne 1994, Steedman 1996, Postal 1998 and Hartmann 1998), in general such phenomena merit scant regard. Right periphery effects are indeed given barely a mention in such theoretically diverse works as Chomsky (1995), Pollard and Sag (1994), van Valin and LaPolla (1997), and Bresnan (2000). To some extent this is unsurprising: right peripheral constructions tend to be more marked than left peripheral ones and less frequent in corpora. However, the fact that rightward dislocation is possible requires explanation.

Many syntactic theories are forced to treat left and right dislocations in a distinct manner. For example, the theory that movement is primarily or exclusively into the specifier positions of Functional projections forces a disjoint treatment for left and right dislocations. Kayne (1994), for example, follows Wexler and Culicover (1980) and suggests a deletion treatment of right dislocations, since rightward movement is disallowed in his framework, while a more conventional account requires a right-displaced constituent to be adjoined to VP, IP or CP rather than be accommodated in the specifier position of a functional projection (see, e.g. Culicover 1997). Of course, it may be that right and left dislocations are indeed substantially

distinct and should be treated differently by the grammar. However, there has been little real attempt to show that this is indeed the case and the null hypothesis, that right and left peripheral constructions are amenable to analysis using the same theoretical machinery, remains a viable and attractive goal. Our task, therefore, is to show, as in Steedman (1996) and Postal (1998), that a particular syntactic theory can achieve this goal. Unlike Steedman and Postal, however, one of our goals will be to show how differences between left and right peripheral effects follow from the theory, while still maintaining that the same mechanisms can account for both sorts of phenomena.

It is, of course, not possible to give a complete account of all left and right peripheral phenomena for even one language in a short paper, let alone provide a crosslinguistic comparison. Our ambitions for this paper are more moderate. What we do is to show, using English as the principal source of data, how the DS approach to the analysis of left-periphery phenomena such as topicalisation constructions extends naturally to the analysis of certain right periphery effects such as pronoun (or clitic) doubling, ‘it extraposition’ and right node raising. These constructions are taken as being illustrative of the class of right peripheral effects since they involve right dislocated constituents and both pronominal and non-pronominal associations with the main clause.

2 The Flow of Language Understanding

According to Dynamic Syntax, the process of natural language understanding is defined through the progressive construction of representations of semantic content as the words of some utterance are parsed in context. Grammatical effects result from the way that such representations are constructed dynamically as a parse proceeds. Like Minimalism (Chomsky 1995), there is only one significant syntactic level, that of Logical Form. Unlike Minimalism, however, logical forms are transparent representations of semantic content, i.e. pure representations of argument structure, which are defined progressively in strictly time linear fashion as an utterance is parsed. There is no characterisation of some independent structure that such strings are supposed to have, no projection of primitive syntactic categories and no encapsulation of constituency as something apart from the establishment of meaningful semantic units. Instead, utilising a restricted set of semantic types, the parsing process attempts to construct a well-formed representation of propositional content through a series of goals (‘requirements’) that have to be satisfied as a parse proceeds. These goals are principally concerned with establishing formulae of certain types which can be combined to yield a binary tree with a propositional formula decorating the topnode.

Natural language understanding is thus modelled as a monotonic tree growth process defined over the left-right sequence of words, with the goal of establishing some propositional formula as interpretation. Taking information from words, pragmatic processes and general rules, the theory derives partial tree structures that represent the underspecified content of a string up to the current point in the parse. Intrinsic to this process are concepts of syntactic underspecification which is manifested in a number of different ways and whose resolution is

driven by the notion of requirements which determine the process of tree growth and must be satisfied for a parse to be successful.

2.1 Requirements and Tree Growth

All nodes are introduced with requirements to be fulfilled. The basic, universal requirement is to build a representation of the propositional content expressed by a string in context, formalised as a requirement to build a tree rooted in type t : $?Ty(t)$, where $?$ indicates the requirement to construct an annotation of the sort that follows it, Ty is a label indicating type and t is the type of a proposition.

To satisfy this (or any) requirement, a parse relies on information from various sources. In the first place, there are general processes of construction which give templates for deriving one tree from another. For example, a general construction rule allows a tree rooted in $?Ty(Y)$ to be expanded to one with argument daughter $?Ty(X)$ and functor daughter $?Ty(X \rightarrow Y)$. By this rule, the initial requirement $?Ty(t)$ may be expanded to give the partial tree in Figure 1 in which the diamond shows the *pointer* indicating the node in the tree that is required to be built next, here the subject node.¹

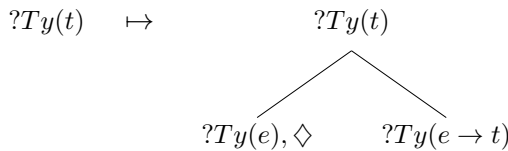


Figure 1: An initial expansion of $?Ty(t)$

Information about tree building may also come from actions encoded in lexical entries which are accessed as words are parsed. An entry like that for the word *John* in (1) contains conditional information initiated by a trigger (the condition that provides the context under which subsequent development takes place), a set of actions (here involving the annotation of a node with type and formula information) and a failure statement which aborts the parsing process if the conditional action fails. The lexical specification further determines, through the annotation $[\downarrow]\perp$, that the node in question is terminal node in a tree, a general property of contentive lexical items.

(1) Lexical Information

| | | | |
|-------------|------|--|-------------------|
| | IF | $?Ty(e)$ | TRIGGER |
| <i>John</i> | THEN | $\text{put}(Ty(e), \text{Fo}(\text{John}), [\downarrow]\perp)$ | CONTENT (actions) |
| | ELSE | ABORT | FAILURE |

The information derived from parsing *John* in *John disliked a student* thus provides an

¹Trees are representations of content with no reflection of linear order. Functor nodes are displayed on the right and argument nodes on the left. In this and subsequent displays, the symbol \mapsto indicates that the tree on the left may be transformed into that on the right.

annotation for the subject node that satisfies the requirement on that node for an expression of type e and the pointer moves on to the predicate node.

Lexical entries may make reference to nodes in the tree other than the trigger node, either building them, or annotating them. To allow this sort of reference, we make use of a number of actions such as `make(\cdot)`, `put(\cdot)`, `go(\cdot)`, and of modal operators over tree nodes, defined by the Logic of Finite Trees (LOFT) (Blackburn and Meyer-Viol 1994). This logic is central to the formal framework and utilises the following operators:

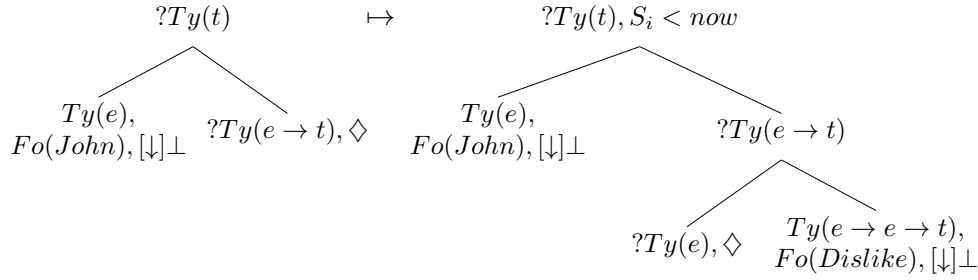
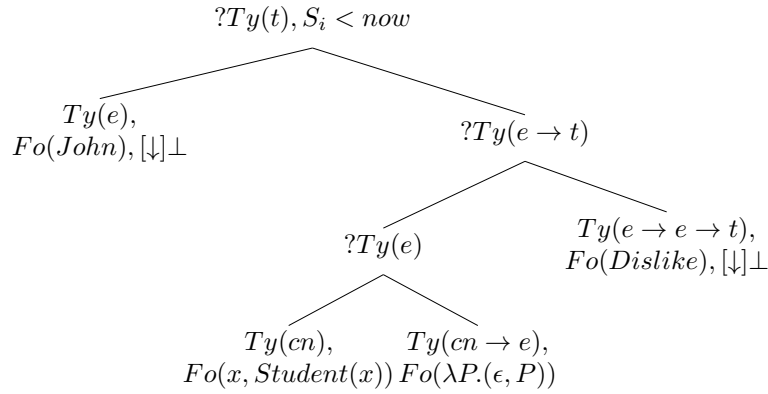
(2) LOFT operators: $\langle \downarrow_0 \rangle, \langle \uparrow_0 \rangle, \langle \downarrow_1 \rangle, \langle \uparrow_1 \rangle, \langle \uparrow \rangle, \langle \downarrow \rangle, \langle \downarrow_* \rangle, \langle \uparrow_* \rangle, \langle L \rangle, \langle L^{-1} \rangle, \langle D \rangle$

In LOFT, modalities are interpreted on the nodes of the trees: e.g. the existential modality $\langle \downarrow \rangle$ is evaluated over the daughter relation, and $\langle \downarrow \rangle Ty(e \rightarrow t)$ holds on a node n if there is a daughter where $Ty(e \rightarrow t)$ holds. More specifically, LOFT has $\langle \downarrow_0 \rangle, \langle \downarrow_1 \rangle$ interpreted over argument and functor daughters respectively; $\langle \downarrow_* \rangle$ over the reflexive transitive closure of the daughter relation (dominance); $\langle \uparrow \rangle$ over the mother relation; $\langle \uparrow_* \rangle$ over the inverse of dominance; $\langle L \rangle$ over a relation of LINK between trees (see below); $\langle L^{-1} \rangle$ over its inverse, and finally $\langle D \rangle$ interpreted over the reflexive transitive closure of the union of daughter and LINK relations. These modal operators may be used in conjunction to allow reference between arbitrary nodes in a tree. For example, $\langle \uparrow_0 \rangle \langle \downarrow_1 \rangle X$ states that X holds of the functor sister of the current node, a modality that is useful for accounting for (e.g.) subject-verb agreement.²

The specific and novel advantage of LOFT emerges from the use of the operators in combination with a generalisation of the concept of requirement $?X$ to any LOFT formula X . Requirements are by no means restricted to non-modal or simple modal requirements. So while $\langle \downarrow_* \rangle Fo(\alpha)$ holding at a node n implies that n dominates a node where $Fo(\alpha)$ holds, $? \langle \downarrow_* \rangle Fo(\alpha)$ holding at n implies that $Fo(\alpha)$ is required to hold at a node dominated by n . By this means requirements may constrain subsequent development of the tree; and this provides a mechanism for pairing non-contiguous expressions, as one imposes some requirement on a node which is fulfilled by an annotation on some discrete node supplied by the other.

By the use of LOFT operators it is possible to encode complex actions within lexical entries, as illustrated by the parse of the verb *disliked* in which the pointer is manipulated by the lexical actions to annotate different nodes. Firstly, it moves to the first open $Ty(t)$ node which is annotated with past tense information, then returns to the predicate node. The functor daughter is then built, and annotated with a type and a formula (the two place predicate representing the relation which the verb is taken to denote). The argument daughter is then built and decorated with a requirement to construct a formula of type e . The pointer remains on this node, indicating that this is to be developed next. The effect of these actions is shown in Figure 2 which illustrates the transition from the tree showing a parse of *John* to the one that results from *John disliked*.

²Like all logical systems used to account for natural language phenomena, LOFT modalities are too powerful in that they allow reference to any node from any other node in a tree, thus potentially allowing dependencies to be stated over arbitrary tree structures. However, any empirically determined constraint on locality defined over trees is in principle statable within LOFT and so can be accommodated into the grammar.

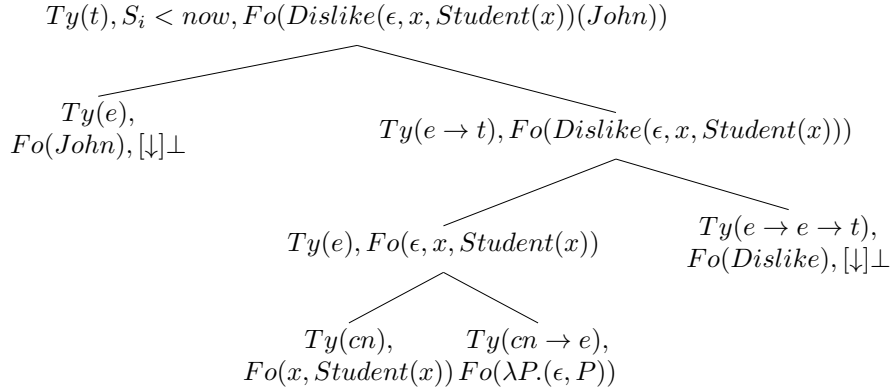
Figure 2: Parsing *John disliked*Figure 3: Parsing *John disliked a student*

Further conditional actions associated with the determiner and common noun in the object noun phrase eventually yields the tree in Figure 3.³ The parsing task is not yet complete, however, as the tree still contains unsatisfied requirements. Completion of the tree involves functional application of functors over arguments, driven by modus ponens over types, to yield expressions which satisfy the type requirements associated with intermediate nodes. Figure 4 shows the completed tree with no outstanding requirements.

2.2 Formula Underspecification

Interacting with tree growth is the processing of anaphoric expressions, the assignment of interpretation to a pronoun. This phenomenon of content underspecification, which we here

³Non-standardly all NPs are taken to project expressions of type e with quantified expressions characterised as variable-binding term operators. That is, NP contents involve the building up of interpretation from a variable, a restrictor, and a variable-binding operator introduced by the determiner, which combines with some formula of cn type (an open formula constructed from variable plus restrictor) to yield a term of type e . See Kempson et al 2001 ch.4,7.

Figure 4: Parsing *John disliked a student*

take in a representationalist spirit (cf. Kempson et al 1998, Kempson et al 2001:ch.1 for arguments), involves lexical projection of a **metavariable** to be replaced by a process of substitution by some selected term. This process is taken to be a pragmatic, system-external one, restricted only in so far as locality considerations distinguishing individual anaphoric expressions preclude certain formulae as putative values to assign to the projected metavariable (i.e. analogues of the Binding Principles, Chomsky 1981, etc.):

- (3) Q: Who upset Mary?
 Ans: John upset her.

In processing the pronoun in (3), the object node is first decorated with a metavariable **U**, with an associated requirement, $?\exists \mathbf{x}.Fo(\mathbf{x})$, to find a contentful value for the formula label. This is achieved by the replacement of the metavariable by a copy of some other term, e.g. *Mary*, from the structure constituting the interpretation of the previous sentence.⁴

2.3 Unfixed Nodes

We have seen underspecification as encoded by requirements to construct nodes of certain types and to identify the formula content of a node. The third sort of underspecification considered here is underspecification of a tree relation, associated with a requirement to identify where in a tree a node should be fixed, its treenode address, $?\exists \mathbf{x}.Tn(\mathbf{x})$.⁵ Such positional underspecification is used to account for long distance dependencies which are analysed in terms of a tree growth process involving initially unfixed nodes whose position

⁴Notice that the substituent for the metavariable is not the English word *Mary* but the term taken to represent the individual referred to by that word in the given context.

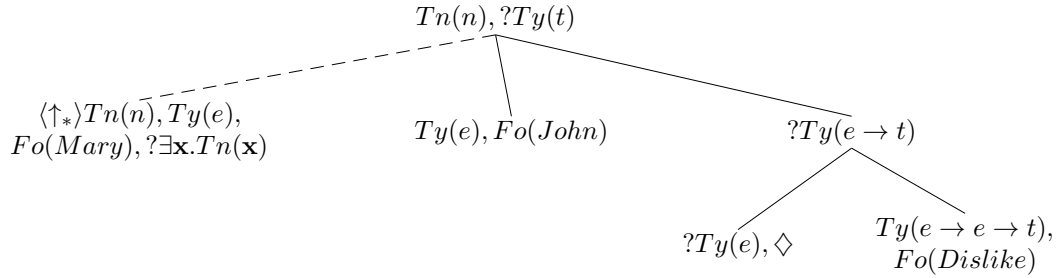
⁵*Tn* is the Treenode label that gives the address of a node which is encoded as a string of 0s and 1s indicating the path of the node from the root, 0, through dominating functor, 1, and argument, 0, nodes.

$$\begin{array}{ccc}
Tn(a), ?Ty(t) & \mapsto & Tn(a), ?Ty(t) \\
& & \vdots \\
& & \langle \uparrow_* \rangle Tn(a), ?Ty(e), ?\exists \mathbf{x}. Tn(\mathbf{x})
\end{array}$$

Figure 5: * Adjunction

in the emergent tree structure is fixed at some later stage in the parsing process.⁶ The construction rule of *Adjunction achieves this effect, defining a transition from an incomplete tree of $?Ty(t)$ with only a single node to a tree that contains in addition a node characterised as dominated by a tree node a by the tree node address $\langle \uparrow_* \rangle Tn(a)$, with requirements to identify the address of the unfixed node and to construct a type e decoration. The effect of this construction rule is shown in Figure 5.

Analysing the string *Mary, John disliked* in these terms is illustrated in Figure 6 with a left unfixed node and the pointer at the object position.⁷ At this point in the parse, all

Figure 6: Parsing *Mary, John disliked*

words in the string have been processed, but there remains outstanding an unfixed node and a requirement to construct a node of type e . In this environment, a process of Merge may take place which unifies the unfixed treenode with the current node to satisfy this requirement.⁸ Ultimately, completion of the tree yields a $Ty(t)$ Formula value, $Dislike(Mary)(John)$, with all requirements fulfilled, thus defining the string as well-formed.

⁶This process bears close formal resemblance to the concept of ‘functional uncertainty’ of Kaplan and Zaenen (1989), articulated within LFG, but that framework lacks the dynamics of updating such uncertainty as part of the structural characterisation.

⁷Here and below, tense information is omitted as not relevant to current concerns.

⁸This process of Merge should not be confused with the process of the same name in the Minimalist Program (Chomsky 1995). In DS, the merge process simply unifies treenode decorations. Provided that no contradictory decorations result, the process is well-formed.

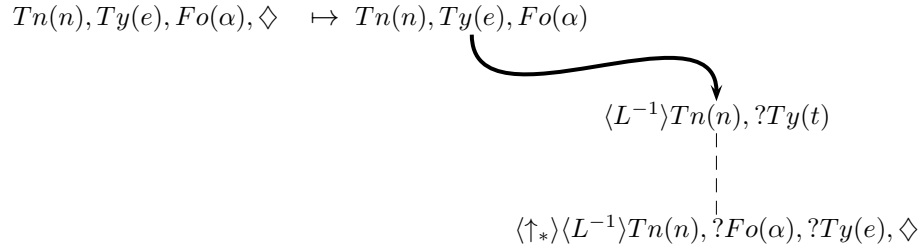


Figure 7: LINK Adjunction

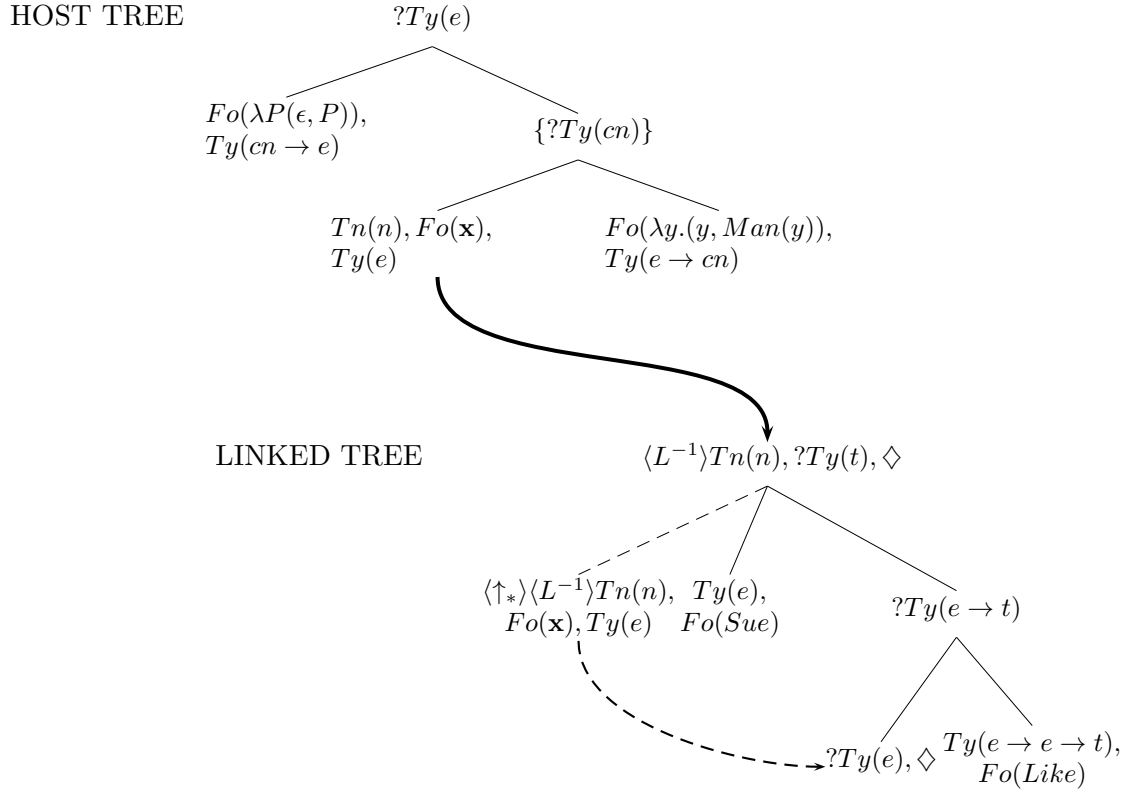
2.4 LINK Structures

The framework also licenses the construction of pairs of trees connected by a LINK relation, described by the operator $\langle L \rangle$ and its inverse $\langle L^{-1} \rangle$.⁹ An initial partial tree provides the context in which a second tree, required to share a common term, is built. In essence the process of Link Adjunction builds a relation from a ‘head’ node in one tree to the top node of new LINKed tree with a requirement $?Ty(t)$ plus a requirement for a copy of the head within that tree. The paradigm constructions that involve the use of this relation are relative clauses, and topic constructions. We take restrictive relative clauses as the pattern. First, in DS all noun phrases are analysed as being of type e . Non-proper NPs also contain a node of $Ty(e)$ which is projected by the variable to be bound by the determiner, and is introduced in parsing the noun. The result of applying the LINK Adjunction rule is shown schematically in Figure 7 where the thick black arrow indicates the LINK relation.

Since the pointer is now at the unfixed node, a successful parse will require there to be a left peripheral constituent in the string: a complementizer or a fronted WH expression. Assuming that we are parsing the phrase *a man who Sue likes*, the WH-expression, as a relative ‘pronoun’ (Jespersen 1933) provides the necessary copy of the variable and puts the pointer back at the top node of the LINKed tree to allow the further development of the embedded clause, as shown in Figure 8.

The subsequent construction of an interpretation for the relative clause follows the general pattern of left-dislocation structures illustrated in the previous subsection: i.e. the unfixed node merges with some node with an appropriate type requirement in the LINKed tree (here the object of *like*). Ultimately, the noun phrase is compiled to give the formula value in (4), where LINK is interpreted as conjunction and the quantifier has scope over both the predicates provided by the common noun and the relative clause.

⁹Analogous to the $\langle \downarrow_* \rangle$ operator, $\langle D \rangle$ ranges over any sequence of $\langle \downarrow \rangle$ and/or $\langle L \rangle$ relations (the reflexive transitive closure of the union of $\langle \downarrow_* \rangle$ and $\langle L \rangle$ relations), and $\langle U \rangle$, conversely, is the reflexive transitive closure of the union of $\langle \uparrow \rangle$ and $\langle L^{-1} \rangle$, i.e. any sequence of mother and inverse-Link relations. These operators allow a relation to be defined between any one node in a set of linked trees and any other node in such a set, thus permitting dependencies into strong islands.

Figure 8: Parsing *A man who*

- (4) a man who Sue likes: $Fo(\epsilon, x, (Man(x) \wedge Like(Sue, x)))$

This is not the only strategy for construing relatives. Other languages make use of obligatory resumptive pronouns, as in (Egyptian) Arabic, where a pronoun is essential in all non-subject positions in a relative clause:

- (5) *il mudarris illi Magdi darab-u*
 the teacher who Magdi hit-him
 The teacher who Magdi hit
- (6) **il mudarris illi Magdi darab*
 the teacher who Magdi hit
 The teacher who Magdi hit

To reflect this distribution, we propose an analysis of the complementiser, *illi*, as inducing the introduction of the linked tree with an associated requirement for a copy, but, unlike English,

not itself providing that copy. Figure 9 shows the analysis of (5), showing the instantiation of the metavariable on the object node projected by the pronominal clitic *-u* with a copy of the metavariable decorating the head (the substitution action being indicated by \Uparrow).

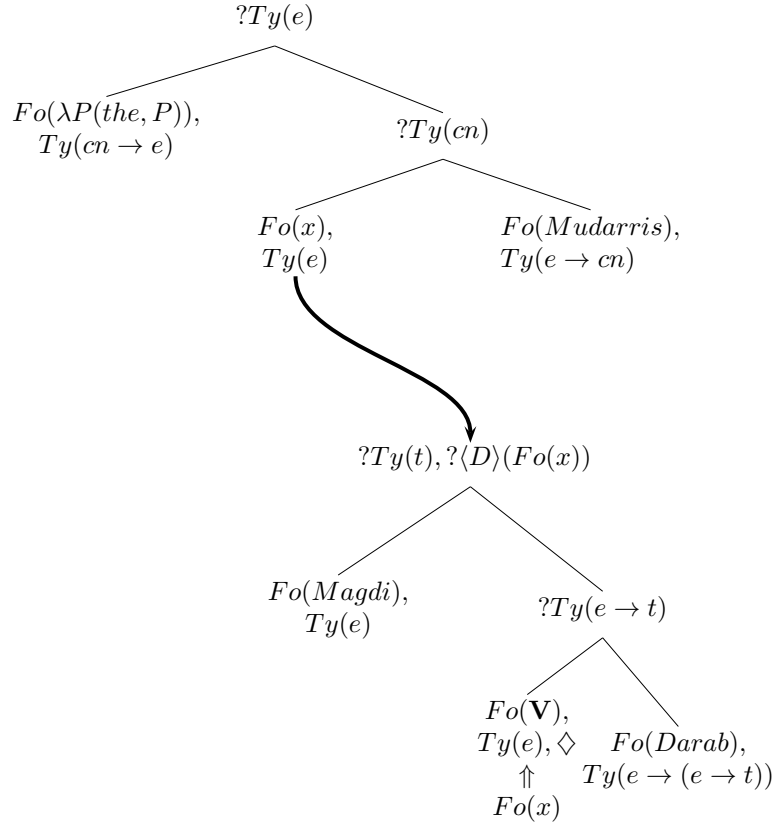


Figure 9: Parsing *Il mudarris illi Magdi darab-u*

The structure in figure 9 notably lacks any unfixed node; and the modal requirement on the top node of the linked tree remains to be fulfilled. This analysis of *illi* ensures that there is only one way of meeting the requirement which it imposes, and that is to use the regular copy process of the language, i.e. selecting as interpretation for some pronoun the value of the formula provided at the head node. Such an interpretation is essential, since any other substituent will leave the LINKed structure with a requirement outstanding, hence not well-formed. In consequence, a pronominal must occur in the subsequent string in a position from which an argument to the predicate can be directly constructed, and, moreover, must be interpreted as providing a copy of the formula annotating the head. This obligatory occurrence of a resumptively construed pronominal needs no separate stipulation, and the substitution process updating the pronominal remains purely pragmatic. It is merely its interaction with the modal form of requirement on the topnode of the LINKed tree which determines the result.

Notice that the same analysis is available for relative clause examples in English which display resumptive pronouns to avoid strong island violations, such as (7a) (apparently non-standard but ubiquitous in spoken English). Resumptive pronouns may also be associated with markedness effects as in (7c-d):¹⁰

- (7) a. This is the house that I don't know its name.
 b. *This is the house that I don't know ('s) name.
 c. The head of the department, who (even) he admits that he needs a holiday, is coming to the conference.
 d. That offensive professor, who I took great care to ensure that I didn't get him as a tutor, is complaining to the head that I don't go to his classes.

3 Two strategies for left-peripheral constituents

With this brief overview of the basic principles of Dynamic Syntax in place, we can now turn to a review of left peripheral effects within the framework.

3.1 'Gap' Constructions

Just as in the previous section with construal of relatives, 'gapped' left dislocation constructions are analysed in DS in terms of the rule of *Adjunction and Merge. *Adjunction provides the necessary machinery to parse the left dislocated constituent by permitting the parse of an expression without determining its address within the tree at that point in the parse. The locality of the attachment of the unfixed node through the Merge operation is determined by the modality associated with the unfixed node. Thus, a node with the modality $\langle \uparrow_* \rangle X$ must be fixed at some arbitrary point within the tree being developed, but not within some LINKed structure, allowing the unboundedness of these constructions but accounting for strong island constraints.¹¹ Thus, the examples in (8a-c) are all fine (consistent with $\langle \uparrow_* \rangle X$) while (8d) is not:

- (8) a. The student Sue gave good marks to.
 b. The student Bill thought got good marks.
 c. The student Sue wanted Bill to think she had given good marks to.
 d. *The student the head of department who liked asked Sue to give good marks to the class.

¹⁰Such resumptive pronouns are characteristically ignored in accounts of English relative clauses, see, for example, Sag 1997 which in other respects provides a comprehensive coverage of different kinds of relative clause. Nevertheless they occur commonly enough in all styles of speech. See Kempson et al 2001 for evidence that restrictions on their use in relative clauses in English is solely pragmatic. See also Cann, Kaplan and Kempson (2003) for a more in depth discussion of this phenomenon.

¹¹Stronger constraints may be imposed by using different modalities, e.g. to analyse strict clause internal scrambling in the Mittelfeld in German, etc.

The fact that unfixed nodes require to be fixed (by the requirement to identify an address for the node) ensures that in the general case there has to be a ‘gap’ (i.e. a node that is completed through the process of Merge rather than lexical input) within the tree. A pronoun cannot, in English, mark the Merge site because it retains its bottom restriction, determined by the modality $[\downarrow]\perp$ in its lexical entry. This effectively prevents the tree expanding below the pronominal node which it would have to do to if a dislocated term is attached at that point.¹²

3.2 ‘Gapless Topic’ structures

The concept of building linked structures in section 2 was restricted to inducing a new tree (whose top node is decorated with a requirement $?Ty(t)$) from some node within a given partial structure. However, we can also straightforwardly define a process of LINK Adjunction between a tree with top node of type e and some second structure of type t , imposing a requirement on that second structure that it contain an occurrence of the formula annotating the topnode of the first. Such a pair of trees can be used to model ‘topic’ structures in languages in which a left-peripheral NP is associated with the presence in the following string of a co-referring pronoun.¹³ An illustrative example is shown in Figure 10 up to the point where the pronoun is parsed but before the pragmatic substitution of the metavariable.

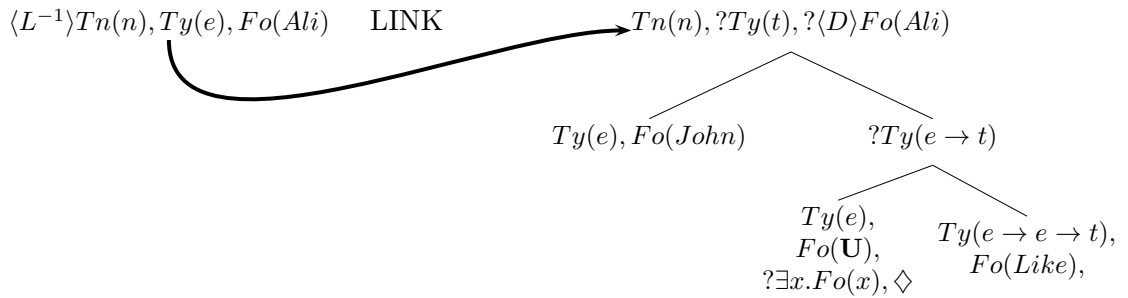


Figure 10: Parsing *As for Ali, I like him*

With no analogue to the relative pronoun in topic structures, the projection of such linked trees will require the presence of a pronoun construed as identical to the interpretation assigned to the left-peripheral NP. This is because, given the modal form of requirement on the top node of the LINKed structure projected for interpreting the clause following that NP,

¹²This bottom restriction of decorating a terminal node in the tree is not violated in relative clause construal, since all that is copied is a formula value, not a node of the tree. This provides a basis for cross-linguistic variation. In certain languages clitics may mark a Merge site, arguably as in Clitic Left Dislocation constructions in Greek and Italian (see Cinque 1990, Dubrovie-Sorin 1990 and subsequent discussion). In such cases, clitics are on their way to becoming pure agreement markers and are analysed in DS as having lost their bottom restriction.

¹³Here, for simplicity, we assume that the compound preposition *as for* induces an annotation on a node of type e , in addition to the construction of the required LINK relation.

$\langle D \rangle Fo(\alpha)$, the copy of the topic formula being a necessary condition to the two trees being ‘linked’, some pronoun must be interpreted as identical to the Fo value projected by that NP in order to yield a well-formed result.¹⁴ As in the case of Arabic relative clauses, this construal of the pronoun is a consequence of the interaction between requirements and the availability of place-holding devices which are subject to a pragmatic process of substitution.

The immediate effect of analysing topic structures in terms of pairs of linked trees is that two strategies are available for analysing left-dislocated NPs (and PPs) in English:

- LINK structures and pronouns for (non-standard) Relative Clauses with resumptive pronouns and Hanging Topic Left Dislocation;
- unfixed nodes and Merge for WH Relative Clauses and Gapped Topics.

From a DS perspective, the difference between the two classes of construction can be seen as a consequence of interaction between two parameters for variation: on the one hand, the distinction between annotation and requirement, and on the other hand, various locality restrictions. Either the left-peripheral NP projects an annotation on an unfixed node within a single tree. Or it is taken as annotating a fixed node of type e , as head, to which a tree interpreting the main clause is LINKed, hence imposing a requirement on that second tree. This distinction between unfixed annotation in a single structure and modal requirement imposed on a LINKed structure from an independent tree yields the distinction between strings for which no pronoun is required (the Move α type of case) and the various processes of scrambling as in Japanese, German etc. (Saito 1985 and many others subsequently) and strings for which a pronoun is required (covering both the topic structures corresponding to Hanging Topic Left Dislocation (van Riemsdijk 1997) and Clitic Left Dislocation (Cinque 1990)).

Secondly, locality varies according to whether the update of such specification (either annotation or modal requirement) has to occur within the same tree, and thus is locally restricted, or may be provided in an additional LINKed tree, hence possibly in a relative clause. This gives us a means of distinguishing languages in which topic structures are associated with a strong island restriction on the relation between left-dislocated expression and the twinned pronoun (identified in Romance as the Clitic Left Dislocation effect), and languages where the topic structure has no such restriction, as in Arabic and the English *as for* construction.

4 Three constructions on the Right Periphery

We now turn to the second task of this paper: to extend the form of analysis sketched above for the left periphery to right-periphery effects. In this section, we explore the applicability of the concepts of LINK transitions and unfixed nodes to the characterisation of three types of right peripheral construction: pronoun doubling, ‘it extraposition’ and right node raising.

¹⁴In languages such as Japanese where there are so-called ‘gapless’ topic constructions, we presume that an additional argument is constructed by pragmatic actions (see Kurosawa 2003).

4.1 Pronoun Doubling

The simplest type of right periphery construction that we consider here is the analogue of Hanging Topic constructions on the left periphery. In left-dislocation structures, we postulated the construction of a LINK relation between a completed node of type e and a node requiring type t . A natural candidate at the right periphery for the converse LINK transition from some completed node of type t onto one requiring type e is the Pronoun Doubling construction:

- (9) a. She talks too fast, Ruth Kempson.
b. He's an idiot, that man at the cashdesk.

In these structures, an anaphoric expression is identified as co-referential with the formula annotating the right-peripheral structure which is optional:

- (10) He's an idiot.

Nevertheless the final expression must be construed as co-referential with some anaphoric expression within the preceding string for the structure to be well-formed:

- (11) *He's an idiot, my mother.

Such structures are naturally interpreted in DS as involving a LINK transition from the rootnode of the propositional tree to some following structure requiring type e , with that term required to be identical to some subterm of the just constructed propositional structure. This accounts directly for both optionality (10) and co-referentiality (9).

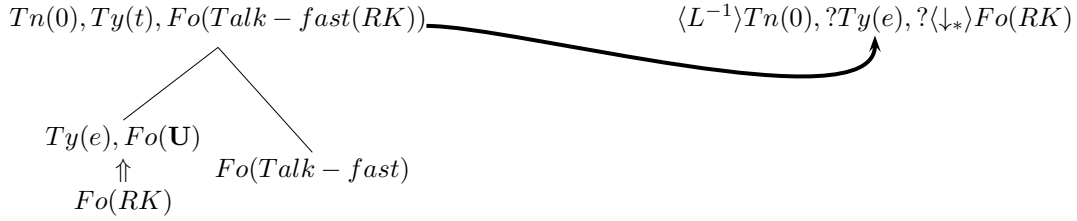
The restriction of these right dislocated expressions to referring expressions (witness **Sue met him, a man*) follows from the fact that the pronoun in the propositional structure is not cataphoric but required to be identified from some larger context in order to complete the propositional tree without outstanding requirements. This assigned value is then carried across as a requirement on the development of the LINKed structure which can only be satisfied by some referential term which itself uniquely identifies that value in context (i.e. a proper name or a definite noun phrase) ensuring that, however that referring expression is subsequently constructed, it must also be assigned the same term as value, a necessary prerequisite for the LINK-imposed requirement, hence well-formedness of the string, to be fulfilled.¹⁵

4.2 'It Extraposition'

'It extraposition' in English involves the right dislocation of a clausal sequence associated with an expletive in subject (12a) or object (12b) position.¹⁶

¹⁵We expect there to be an analogous LINK transition between two structures of type e (with no periphery effects), and indeed there is: *He, that man at the cash desk, is an idiot*.

¹⁶The status of object expletives is controversial (cf. Postal and Pullum 1988 for an overview and Rothstein 1995 for an opposite view).

Figure 11: Parsing *She talks too fast* with LINK transition

- (12) a. It was clear to all that the sun would not shine that day.
 b. I proved it to my own satisfaction that the analysis was coherent.

It might seem that such examples could be analysed as a LINK relation projected from a completed $Ty(t)$ structure, containing a metavariable introduced by the expletive, to another structure of $Ty(t)$ which is required to instantiate that metavariable. There are, however, strong reasons for rejecting such an analysis. In the first place, LINK structures are always optional whereas the extraposed constituent is necessary if *it* is an expletive (13a,b). Secondly, extraction from a LINK structure is not permitted in English hence the ungrammaticality of (13c), whereas extraction from an extraposed clause is fully grammatical (13d). Finally, the value of the metavariable projected by the pronoun must be construed as the formula value of the whole clause and not some subpart of that clause (13e), which would be unexpected if the right dislocated clause were a LINKed structure associated with a requirement $?<D>Fo(\mathbf{U})$.

- (13) a. It is certain.
 b. *It might seem.
 c. *What did a man come in who liked?
 d. What was it clear that Thomas didn't say?
 e. It was clear to everyone that Kim thought that Sue had flunked her exams.
 = That Kim thought that Sue had flunked her exams was clear to everyone.
 ≠ That Sue had flunked her exams was clear to everyone.

Rejecting the LINK analysis leaves open the possibility that some form of right peripheral unfixed node is involved here. In general, however, such a possibility is not permitted within DS because of the nature of the strict left to right parsing process. Requirements on a node currently being parsed must be met by lexical action or by computational rule. As the parsing process aborts if this does not occur, 'gaps' cannot be updated from some term introduced later in the string. There can be no right analogue of gapped left dislocation:

- (14) a. That woman at the cashdesk I heard was sick.
 b. *I heard was sick, that woman at the cashdesk.

(14b) is ungrammatical because with the pointer at a subject node after parsing *I heard*, the lexical information provided by the auxiliary cannot satisfy the requirements of that node, and the parsing process aborts. It is thus only in the presence of some device such as an appropriate lexical item or an unfixed node as in (14a) which can satisfy the type requirement on the subject node that the parsing process can proceed.

It might seem then that an analysis of the extraposition examples in (13) cannot be given in terms just of LINK structures and unfixed nodes, thus indicating that certain right peripheral effects are significantly distinct from those found on the left periphery. However, we propose that certain expressions, like expletives, project a metavariable which satisfies a type requirement, allowing the parse to proceed, but which nevertheless requires a fixed Formula value to be provided subsequently through some form of Merge. This is precisely what is needed for an analysis of it-extraposition. The basic analysis is shown in Figure 12 where the expletive projects a metavariable, \mathbf{U} , of type t , which is strictly ‘anticipatory’, i.e. it cannot be satisfied by some term already constructed. This anticipatory effect is achieved by defining the lexical actions associated with the pronoun in such a way that in the output tree the pointer appears, not on the node decorated by the metavariable, but on the open predicate node. As Substitution may only occur when the pointer is at the node that requires a formula to be substituted, the effect is to ensure that the value of the metavariable can only be determined by some propositional expression that is projected by some later expressions in the string. The effect of the lexical actions associated with parsing *it* is thus as shown in Figure 12.

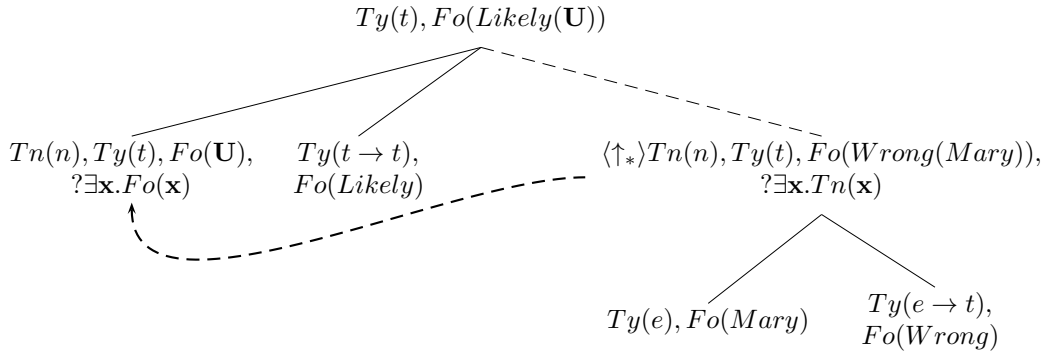


Figure 12: Parsing extrapositive *it*

At this point, the verb phrase *is likely* is parsed,¹⁷ satisfying the requirement to find an expression of type $Ty(t \rightarrow t)$. The initial proposition is now type-complete and is compiled to give a *formula incomplete* propositional tree rooted in $Fo(Likely(\mathbf{U}))$. An unfixed node is now constructed on the right periphery which supplies the value for this metavariable through a process of Merge. This development in the parse of *It's likely that I'm wrong* (spoken by Mary) is shown in Figure 13.

The question now arises as to whether to use some generalised form of *Adjunction defined for the left periphery, allowing introduction of unfixed nodes at arbitrary points in the tree-construction process. This we do not do, preferring to retain two discrete *Adjunction processes in order to capture: (i) the fact that such clausal sequences must follow the predicate cf. (15); (ii) the freedom for such right peripheral adjunction to apply iteratively (as we shall

¹⁷Details of how copular clauses are parsed is omitted here.

Figure 13: parsing *It's likely that I'm wrong*

see in the analysis of Right Node Raising), which left-peripheral *Adjunction (at least as defined for English) precludes.

- (15) a. *It is that John will succeed likely.
 b. *It that John will succeed is likely.

The rule of Right*Adjunction states that in the presence of a type-completed propositional structure whose rootnode lacks a full formula value (hence containing at least one metavariable), a transition is licensed to introduce an unfixed node within the same tree, as shown in Figure 14.

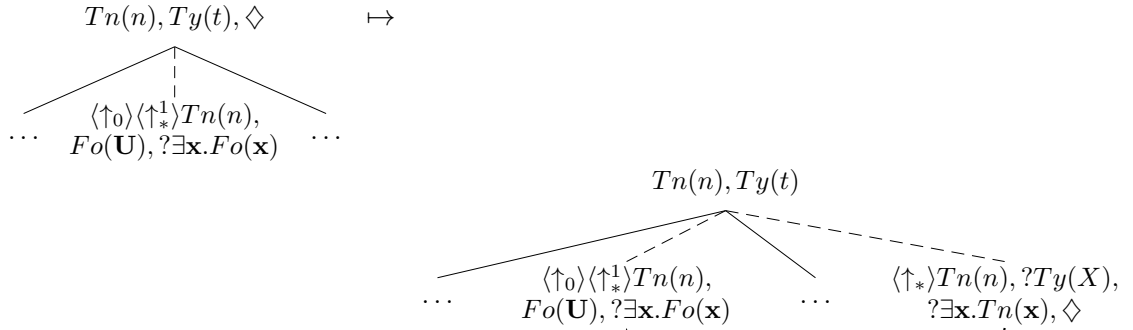


Figure 14: Right*Adjunction

Notice that the metavariable in the completed $Ty(t)$ subtree is required to be local, where a node projected in a clausal sequence is ‘most-local’ on a resulting structure to a node $Tn(n)$ if it is related along a chain of one argument relation ($\langle \uparrow_0 \rangle$) and a possibly empty sequence

of functor relations ($\langle \uparrow_*^1 \rangle$) to that node.¹⁸ This condition ensures that the unfixed node must be fixed locally with respect to that tree (to instantiate the metavariable), yielding the well-known Right Roof Constraint of Ross (1967).

The transition shown in Figure 14 necessarily follows the development of a predicate within that structure. However, what is disallowed is any such propositional structure induced from expressions occurring between those projecting annotations for the subject and predicate nodes. This possibility is precluded not only because there is no free *Adjunction process, but also because, once a variable satisfies a type requirement, albeit empty, no further development of that node by application of the general construction rule for introducing daughter nodes is possible because the required input condition for such rules is not met, viz. a *requirement* to construct a tree rooted in type X , $?Ty(X)$ (see section 2.1). Hence the ungrammaticality of (15a,b). The fact that a complement clause may follow immediately subsequent to an object expletive is due to their right-peripheral position, and not to any weakening of this restriction:

- (16) a. I proved it to my step-mother that John was a genius.
 b. *I proved it that John was a genius to my step-mother.

With this discrete subvariant of *Adjunction, we allow the projection of unfixed nodes at two points in the parse process only: initial in the projection of a tree structure (though possibly following upon the projection of an independent LINKed structure, so not necessarily string-initial); and following the development of the predicate.

4.3 Right Node Raising

The use of anticipatory metavariables and Right*Adjunction can be used in conjunction with the concept of LINKed structures to analyse Right Node Raising (RNR) structures.

- (17) a. John criticised, and then Mary reassured, that woman from Birmingham.
 b. John gave to Mary, and subsequently Harry retrieved from Sue, the notes from Ruth's course that John had diligently taken.
 c. John doubted, but Harry insisted, that Susan was happy.
 d. John was keen, but Harry was determined, to get to the final.
 e. John passed on, and Harry distributed, the notes from Ruth's course to any student that asked for them.

This 'extraction' process can target constituents of various types (17c,d) and more than one constituent can be dislocated (17e) (so-called non-constituent extraction). Moreover, though characteristically indicative of some constituent missing from a final position in both clauses from which it appears to have been dislocated, RNR does not impose any constraint that the

¹⁸This domain is analogous to the concept of locality articulated in other frameworks as the (principle A) restriction for anaphors.

constituent in question be final in the string, as witness (17b). Such nonstandard constituents might appear to be best expressed in terms of string-movement (or string-deletion at PF, see Hartmann 1998), an analysis impossible for a framework like DS which can only make reference to partial semantic structures, and not to (structure defined over) strings. However, there is a straightforward account within Dynamic Syntax if we assume that an essentially anticipatory metavariable may be constructed as a promissory note allowing parsing to proceed, even though no fixed formula value has been provided. Such a variable, once constructed, has a life like any other variable, and may be copied over a LINK transition to a second correlative LINKed structure where the node it annotates is merged with a right-adjointed unfixed node.

Accordingly, we propose the set of lexical actions in (18) that have the effect that a node requiring some type e node that is dominated by a predicate node may be filled with a metavariable that requires a later update as replacement. The actions are triggered by an open requirement of any type and a check is made to see whether this node is dominated by some predicate node.¹⁹ If the predicate condition is met, a metavariable is added as decoration to the node, satisfying the type requirement. The pointer then moves on to the mother node, preventing pragmatic substitution.

(18) *Lexical Metavariable Insertion*

| | | | |
|------|----------|---|------------------------------|
| IF | $?Ty(X)$ | | <i>Trigger</i> |
| THEN | IF | $\langle \uparrow_0 \rangle \langle \uparrow_*^1 \rangle ?Ty(e \rightarrow t),$ | <i>Condition</i> |
| | THEN | $\text{put}(Fo(\mathbf{U}), Ty(X),$ | <i>Metavariable and Type</i> |
| | | $? \exists \mathbf{x}. Fo(\mathbf{x}),$ | <i>Formula Requirement</i> |
| | | $\text{go}(\uparrow_0)$ | <i>Pointer movement</i> |
| | ELSE | ABORT | |
| ELSE | ABORT | | |

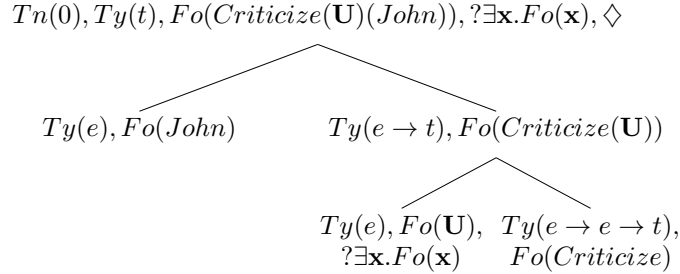
This option is invariably made manifest by a particular form of Intonation, a restriction on what would otherwise be an extremely free process (threatening to allow any order of words for any postverbal constituent). We have, however, stated the lexical entry with no encoding of the intonation itself, taking this to be simply a means of ensuring suitable manifestness of this option. The status of prosodic information within the system remains an open question, but clearly intonation forms part of the phonetic signal and thus is available to induce interpretive procedures during the course of a parse. In a system like DS where parsing is to the fore, such an approach is entirely natural.²⁰

¹⁹Note that this rule is restricted to occur within the development of the predicate in order to preclude: **I know was clever, but Sue rightly said was arrogant, that dreadful bully from LA.*

²⁰Note the parallel with topic structures, where some requisite intonation is almost universally said to be a defining characteristic of the structure. Without the characteristic intonation associated with RNR, the first conjunct will be construed as the intransitive predicate, cf:

i. John sang, and Mary read a book.
ii. John sang, and Mary translated, that Schubert love-song.

To exemplify, the analysis of (17a) proceeds as follows. Licensed by intonation, a metavariable is constructed as annotation to the object node induced by the first predicate, satisfying its type requirement. The first conjunct is compiled and completed retaining the metavariable with its associated formula requirement (Figure 15). A LINK relation is projected by the

Figure 15: Parsing *John criticized*

lexical actions associated with the conjunction *and*, shown in (19) which encodes generalised conjunction, i.e. the projection of a LINKed node of the same type as the current node.

(19) **IF** $Ty(X)$
and **THEN** $\text{make}(\langle L \rangle), \text{go}(\langle L \rangle), \text{put}(?Ty(X))$
ELSE ABORT

A separate construction rule copies over a metavariable with an unsatisfied formula requirement from a first tree of type t , as a requirement onto a second tree of the same type, the effect of which is shown schematically in Figure 16.²¹

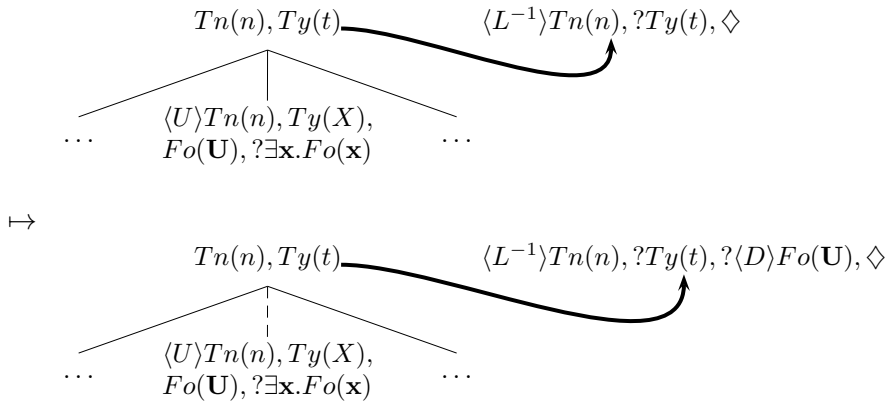


Figure 16: LINK dependency

²¹This rule only copies over one metavariable but can iterate to allow multiple dependencies. See also Cann et al. (to appear) for more discussion of co-ordination and a formulation of the rules involved.

Applied to the analysis of the current example, the tree in Figure 17 results from parsing the conjunction and applying the LINK dependency rule.

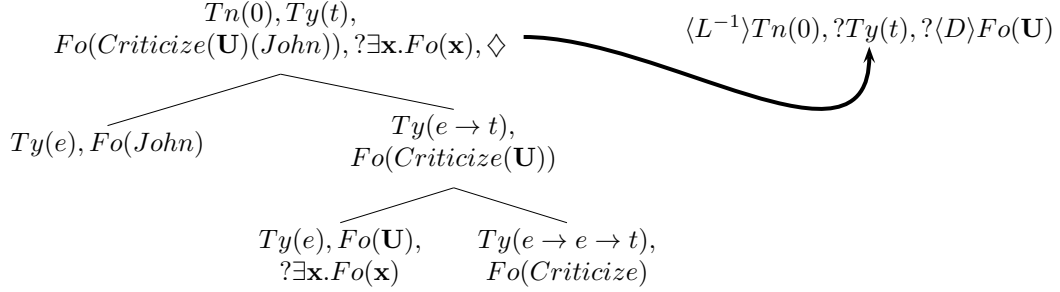


Figure 17: Parsing *John criticized and*

In parsing the second conjunct, Metavariable Insertion provides the required copy of the metavariable in the appropriate position and the conjunct is compiled. At this point, the rule of Right*Adjunction introduces the node to be decorated by construal of the right peripheral noun phrase, a node which is then merged with the second conjunct, as in Figure 18.²²

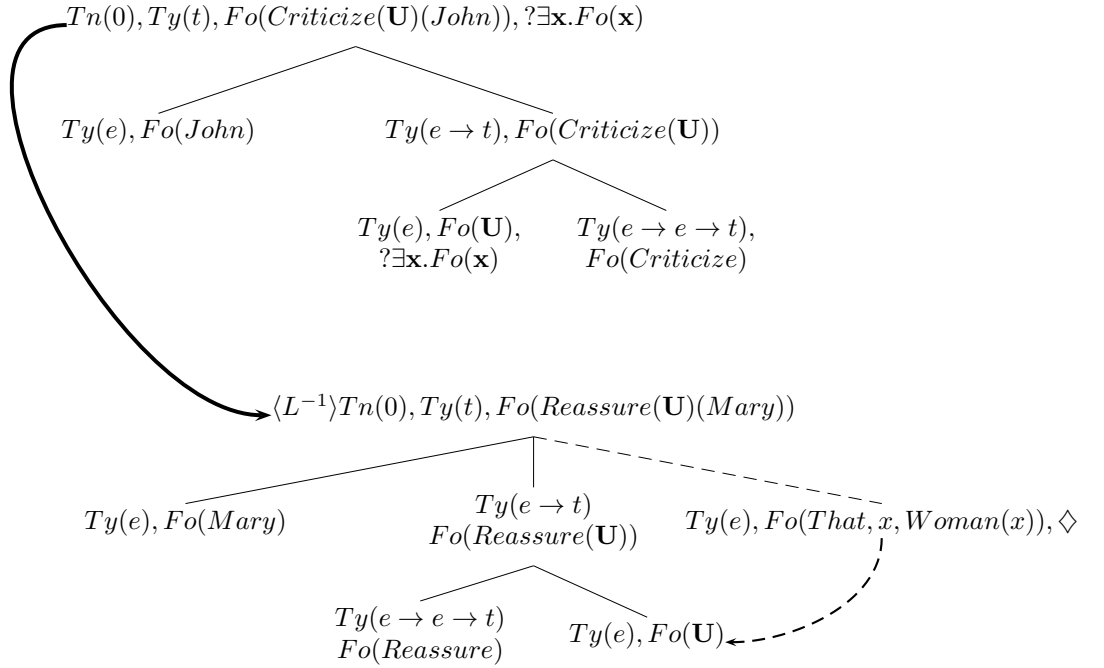


Figure 18: Parsing *John criticized and Mary reassured that woman*

²²The internal structure of the right dislocated term is omitted and the order of functor and argument in the predicate of the second tree is reversed for ease of reading.

Once the Merge process has led to the instantiation of the metavariable in the second conjunct, then, by anaphoric update, the metavariable in the first conjunct will be substituted by the same value, in (20) the formula, $(That, x, woman(x))$.

$$(20) \quad Fo(Criticise(John, (that, x, Woman(x))) \wedge Reassure(Mary, (that, x, Woman(x))))$$

In sum, this analysis of RNR utilises unfixed nodes and LINK structures on the right periphery which differ marginally from their use on the left periphery, providing support for these processes as general linguistic devices and for the hypothesis that differences between left and right peripheral constructions are essentially due to the left-to-right dynamics of the system.²³

The theory differs from all other accounts of which we are aware, but incorporates some insights from apparently irreconcilable theoretical approaches. Given that *Adjunction is the DS analogue of Move α , the fact that the right peripheral expression is unfixed gives the analysis some commonality with right raising accounts such as proposed in Postal (1993, 1998). In particular, the ‘extraction’ is subject to locality conditions, which are here determined by the modality expressed in the Right*Adjunction rule, requiring strict locality within the minimum $Ty(t)$ domain (the Right Roof Constraint).

However, there are also important common properties with in situ analyses such as those of Hartmann (1998) and McCawley (1982, 1987). Since the right dislocated constituent is necessarily merged with a node within the second conjunct, constraints that operate within non-dislocated structures automatically apply to the right dislocated structure. For example, the construal of a pronominal anaphor in a right dislocated constituent is subject to the same constraints as if it were in situ (see (21) based on 5b, 5b’ in McCawley (1987:187)).

- (21) a. I know that Bill said, and Mary_i happens to agree, that she_{i/j} needs a new car.
 b. I know that Bill said, and she_i happens to agree, that Mary_{*i/j} needs a new car.

Nevertheless, there is a striking difference between our analysis and all others. In characterising the right-node-raised structure as right-peripheral, i.e. unfixed locally within the second conjunct: the occurrence of the formula from that node within the first conjunct is secured solely through the cataphoric properties of the anticipatory metavariable. This leads us to expect an asymmetry not available to any other analysis.²⁴

- (22) a. John has read, but he hasn’t understood, any of my books.
 b. *John hasn’t understood, but he has read, any of my books.

²³This analysis provides, in effect, a version of Conditional Introduction in natural deduction: an assumption is made, i.e. that there is a formula of type X , which is discharged at the top level as the requirement $? \exists \mathbf{x}. Fo(\mathbf{x})$, effectively to give an implication, $X \rightarrow t$ (since the requirement must be satisfied to give a well-formed propositional representation). Combining this with a formula of type X , i.e. that given by a right dislocated expression, gives a propositional representation through modus ponens.

²⁴Hartmann notes the existence of these examples, but grants that she has no account of them.

We hypothesize that negative polarity items have a context-sensitive condition for their update action, taking *any* to project an indefinite term as *Fo* value only in the presence of a negative (or ‘affective’) feature decorating its locally dominating propositional type node.²⁵ The NPI condition is met by the second conjunct in (22a), hence the update is licensed. Upon this account, in conjunction with the present analysis of right-node raising, the object node in the first conjunct of (22a) is first decorated with a metavariable and then subsequently annotated with a term identical to whatever value is assigned to the second occurrence of the metavariable constructed in the second conjunct. This being the indefinite term projected by *any*, its presence is duly licensed also in the first conjunct, despite the lack of negation. Sensitivity to the presence of negation is not required for the indefinite term itself: it is merely a condition on the tree in which the lexical item *any* is to provide an update. The NPI is not licensed in the second conjunct of (22b), however, and the example is duly ungrammatical.

Similarly, clashes in the selectional properties between the predicates in the two conjuncts will be more tolerable if resolved solely with respect to the second conjunct but not if resolved solely with the first. Hence, (23a) is preferable to (23b).

- (23) a. John intended to, but Sue prevented him from, submitting a paper.
 b. *John intended to, but Sue prevented him from, submit a paper.

Contrary to assumptions normally made in the literature, although incompleteness will normally only be straightforwardly expressible at some recognised right periphery of the first clause, this is not necessary to the characterisation of the semantic structure, hence the possibility of non-final constituents in the conjuncts being construed through RNR as in (17b). Furthermore, since, in principle, there may be more than one such variable in an incomplete structure, this process of Right*Adjunction may occur more than once, subsequent Merge happening successively. Thus apparent non-constituent right dislocation as illustrated in (17e) and (24a) is straightforwardly accounted for in our analysis. Note in this regard that the order of the dislocated constituents need not be in their canonical order, as in (24b,c).

- (24) a. Bill offered, and Sue actually gave, the princely sum of £50 to the best student in the year.
 b. Bill offered, and Sue actually gave, to the best student in the year the princely sum of £50.
 c. John passed on and Harry distributed to any student that asked the notes from Ruth’s course.

²⁵The lexical actions associated with NPI *any* may be given as:

| | | | |
|---------------------------|-------|-----------------|--|
| <i>any</i> _{NPI} | IF | ?Ty(<i>e</i>) | |
| | THEN | IF | $\uparrow_0 \uparrow_* \uparrow_1 + NEG$ |
| | | THEN | make ($\langle \downarrow_1 \rangle$), go ($\langle \downarrow_1 \rangle$), |
| | | | put ($Fo(\lambda P.(\epsilon, x, P))$, $Ty(cn \rightarrow e)$), go (\uparrow_1), |
| | | | make ($\langle \downarrow_0 \rangle$), go ($\langle \downarrow_0 \rangle$), put ($?Ty(cn)$) |
| | ELSE | ABORT | |
| ELSE | ABORT | | |

As we would expect in the light of the earlier analysis of the expletive *it*, expletives can also give rise to a copying of their projected metavariable across a LINK transition, and we get RNR effects:²⁶

(25) It is likely, but it is not unreasonable, that our analysis will fail.

Further evidence in favour of our analysis of RNR comes from an unusual source. It has long been noted that extraction to the right of the internal object in double object constructions in English is not permitted (Steedman 1996, Postal 1998, *inter al.*).

- (26) a. Sandy gave the woman apples and Lou gave her pears.
b. *Sandy gave apples, and Lou gave pears, the woman down the hall.

Accounts of this phenomenon have not been very illuminating, however. Postal (1998:115) simply has an arbitrary constraint against extraction of these objects, either to the left or to the right.²⁷ Steedman (1996) uses a [-SHIFT] feature on the input category for this constituent (i.e. (VP/NP)/NP[-SHIFT]) to prevent the operation of rightward combinatorial rules from deriving such structures. This feature is also used to account for constraints on preposition stranding, so is at least a stipulation with a wider domain. Levine (1985, 2000) proposes that such constituents cannot be right dislocated because there is a general constraint against right dislocating any constituent that cannot be ‘rightmost in its VP’. It is not, however, clear what force this has since it appears to us that the only reason to say that internal objects of this kind cannot be rightmost is that they cannot appear to the right of any other object or adjunct, which is just another way saying that they do not engage in Heavy NP Shift or Right Node Raising. In DS, in any case, since there is no concept of constituent or any characterisation of the structure of a natural language string, such a characterisation has no meaning.

Interestingly, although we do not have an explanation for the phenomenon, our analysis predicts that it should occur, given other properties apparent in the grammar of English. As noted in Kempson et al 2001, amongst others, an indefinite NP as the first NP in a double object construction cannot be construed as dependent on a quantifier in the following object (27a), even though such a dependency is possible if the indirect object follows the direct object (27b) and there is no parallel constraint on the possible dependence of a direct object on a quantifier in a following indirect object (27c).

- (27) a. I showed a student every book by Chomsky in my collection. (*not ambiguous: $\exists\forall$ only*)

²⁶Note that the extraposed constituent can be construed relative to the individual conjuncts. Given that this RNR process is part of the construction of the individual conjuncts, this is not surprising as the evaluation of those trees once complete follows any such process, hence allowing different opaque construals of the *it* expletive.

²⁷Leftward extraction is, however, acceptable to many, at least in Standard Southern British English:

- i. Who did Sue sell a table for £500?
ii. Who did Bill lend his only copy of Syntactic Structures?

- b. I showed every book by Chomsky in my collection to a student in my syntax class. (*ambiguous*)
- c. I showed a book by Chomsky to every student in my syntax class. (*ambiguous*)

Furthermore, reflexives in this internal object position also cannot be construed as dependent on a following object (28a), even though the dependency is possible between a direct object and a following indirect object (28b).

- (28) a. *John showed herself a picture of Sue.
 b. John showed a picture of herself to Sue.

The indirect object position thus shows an anti-anticipatory constraint with respect to both quantification and reflexivisation. The fact that our analysis of RNR utilises what is effectively an anticipatory metavariable (a null cataphoric pronoun) properly predicts the ungrammaticality (28b): an anticipatory term is incompatible with an anti-anticipatory condition. Although we do not have an explanation of why this anti-anticipatory condition should hold on the indirect object node of double object constructions, the fact that it does, provides buttressing evidence for our analysis of RNR as involving a null cataphoric element.

Finally, note that dislocation from a strong island is licensed in our account of RNR:

- (29) Bill likes the man who sells, but Sue detests the woman who buys, obscene photographs of British politicians.

This analysis does not result from any weakening of the Right Roof Constraint imposed by the modality associated with Right*Adjunction, but from the $\langle D \rangle$ modalities introduced by the lexical actions associated with correlative conjunctions such as *and*, *but*, etc, the LINKed structure being required to have a copy of the anticipatory term anywhere in the subsequently developed structure. Nevertheless the node projected from the right-peripheral item is constructed as an unfixed node within whatever local tree is constructed from the immediately preceding incomplete clausal string, with which it will, in all well-formed completions, duly unify. Thus, such dependencies are only licensed by these expressions, but not by merge on the right periphery which remains local to some $Ty(t)$ subtree.

We have now provided an account of a number of right peripheral constructions in English, using the tree construction devices that are necessary to analyse the left periphery within DS, viz. locally unfixed nodes and LINK structures. We have analysed Pronoun Doubling (afterthought) constructions as involving a LINK structure from a completed $Ty(t)$ to a type e tree. ‘It extraposition’ is analysed in terms of a right unfixed clausal node which substitutes for an metavariable projected by the expletive. Right Node Raising involves the use of LINK structures and right unfixed nodes, but also the projection of metavariables licensed by intonation with formula requirements which can only be satisfied by some string that comes later in a parse. This range of data is notoriously intransigent for most frameworks, but their analysis follows, with minimal stipulation from the construction possibilities made available with in Dynamic Syntax.²⁸

²⁸Our account, although reasonably comprehensive, leaves to one side problems with respect to preposition stranding in RNR constructions. It is not possible to extract two prepositional complements (i) or a direct

5 Conclusion

In conclusion, we compare the interpretation processes that give rise to left and right periphery effects. We have defined analyses for left-peripheral and right-peripheral phenomena in terms of the construction of LINKed structures into which unfixed nodes may be introduced. The LINKed structures range over pairs of type t structures or pairs containing one type e and one type t structure. The applications of a LINK transition either from an independent structure of type e onto a type- t -requiring structure, or from a propositional structure to a type- e -requiring node are symmetrical, defined in each case from some completed structure onto a node requiring some type, both sharing the restriction for a common term in the two structures.

The processes of *Adjunction that apply at the outset of building a propositional structure or subsequent to its completion both involve the building of unfixed nodes. However these rules reflect the different potential for update at the different stages in the interpretation process, and are not symmetrical. At the left periphery a node can be constructed and fully annotated without a specific tree-node position, and the task of tree construction must therefore include an identification of when Merge can take place. At the right periphery on the other hand, a fully propositional structure is already projected, possibly containing one node whose Formula value is incompletely specified, and, if so, it is the content of one of the nodes of this structure which has to be provided. Both processes of *Adjunction are applicable independent of whether the containing structure is or is not LINKed to some other structure, so the various LINK transitions and *Adjunction processes can occur in combination.

As we would wish, clausal strings are modelled as displaying the projection of a core structure, around which other nodes may apparently be constellated. And in the phenomenon of Right Node Raising, the explanation naturally extends to data known to be intransigent in other analyses. Though we have defined subcases of a general process, with a number of LINK transition rules, there are no stipulations particular to an individual type of structure: all we have used is the dynamics of building partial trees as partial decorations, updating these monotonically following the sequence of words. With concepts of LINKed trees and unfixed nodes thus providing a basis for related but non-identical left and right dislocation effects, we

object and a prepositional object (ii). Nor is it possible to strand of internal prepositions (iii) (which Postal 1998, erroneously, claims to be grammatical).

i *I talked to about, and the Kim also talked to about, the woman down the hall her noisy lovers.

(cf. I talked to the woman down the hall about, and the Kim also talked to her about, the noisy neighbours downstairs.)

ii *Bill offered to, and Sue actually gave to, £300 the best student in the year.

(cf Bill offered 300 to and Sue actually gave £100 to, the best student in the year.)

iii *Mike may have talked to about love and certainly talked to about marriage the tall woman in the black dress.

(cf. Mike may have talked about love to and certainly talked about marriage to the tall woman in the black dress.)

These are predicted to be acceptable in our analysis as Variable Insertion is not sensitive to positional constraints and may apply iteratively. Such data, however, seem to be problematic for all theories of RNR and we leave them here as questions for further research.

conclude that there is clear indication that grammar formalisms for natural languages should reflect the dynamics of left to right processing.

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